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Explaining Adolescent Drug Use in Adjacent Generations: Testing the Generality of Theoretical Explanations

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Abstract

We tested the assumption that theories of drug use are able to account for behavior across varying contexts and populations by examining whether control, learning, and elaborated theories provide similar explanations for adolescent drug use in adjacent generations. We used data from the Rochester Youth Development Study and Rochester Intergenerational Study which followed a sample of adolescents starting at age 14 and their oldest biological child. Cross-generational analysis between theoretical variables measured at age 14 and drug use measured at approximately ages 15 and 16 were used. Regression models testing for each theoretical framework found that in general, they appear to operate similarly in adjacent generations. We conducted 14 tests of equality for pairs of coefficients across the generations; no statistically significant differences are observed. Overall, these theories offer general explanations for adolescent drug use with respect to risk and protective factors for parents and their children. Theoretical and policy implications are discussed.

Keywords

Drug use; intergenerational; theory testing; theoretical generality

Introduction

One way in which theories of human behavior are evaluated is by assessing their applicability to different situations, locations, groups, and time periods. Theories that can

account for behavior equally well regardless of the context or population examined are more useful than theories that are limited in their scope. Moreover, some theoretical perspectives lay claim to being general theories in that they explicitly suggest that the relationships and causal processes they specify should apply quite broadly. That is certainly the case with several core theories that are used to explain adolescent substance use and related problem behaviors. In fact, there have been a number of studies that have explored the generality of these theories. Studies have focused on the applicability of theories across gender (Booth, Farrell, & Varano, 2008; Daigle, Cullen, & Wright, 2007; Heimer & De Coster, 1999; Piquero, Gover, MacDonald, & Piquero, 2005), racial and ethnic groups (Cernkovich & Giordano, 1992; Junger & Marshall, 1997; Matsueda & Heimer, 1987), and location (Gardner & Shoemaker, 1989; Sigfusdottir, Kristjansson, & Agnew, 2012; Vazsonyi & Belliston, 2007).

There have been far fewer studies that systematically examine the generality of theories across different eras or generations, yet the increasing availability of studies that include data from adjacent generations of the same family affords scholars the opportunity to rigorously test if the same risk, protective, and causal processes that account for drug use at one time period for one generation apply at a later time period for the next generation. Intergenerational studies typically start from an original longitudinal study that followed a focal participant, often referred to as Generation 2 (or G2), as well as a parent (Generation 1 or G1). Several recent studies (e.g., Bailey, Hill, Oesterle, & Hawkins, 2006; Capaldi, Pears, & Kerr, 2012; Conger, Neppl, Kim, & Scaramella, 2003) have extended the investigation of drug use and comorbid behaviors to focus on the children of the initial G2 participants, adding a third generation (G3) to the study. The primary purpose of these intergenerational extensions is to examine the extent to which there is cross-generational continuity in the behavior of interest and to identify mediating and moderating influences that help account for it. Within this overall framework, a specific research question focuses on the extent to which risk and causal processes are the same across the generations. If theories of deviant behavior are general, they should apply across time and the explanatory factors that predict G2 drug use during adolescence should also predict to a similar extent, the drug use of their G3 children during adolescence. If theories do not generalize across generations, that would raise a host of questions about the theoretical adequacy of the models, as well as their ability to guide the development of effective prevention and treatment programs.

Although theoretical generality is a core, but often implicit, assumption of most theories of deviant behavior, there is surprisingly little empirical investigation of whether or not they apply equally well across generations. In fact, we have found only one study of this issue that focuses specifically on explanations for substance use (Menard & Johnson, 2015) and two others that examine delinquency (Farrington, Ttofi, Crago, & Coid, 2014; Johnson, Morris, & Menard, 2012). They are reviewed below. The purpose of this study, therefore, is to extend this line of research and examine whether core theories of deviant behavior explain the adolescent drug use of both a parent and their child equally well.

Theoretical Perspectives

We will focus on three theoretical perspectives for our cross-generational analysis, social control theory (Hirschi, 1969), social learning theory (Akers, 1998), and elaborated models that combine variables from both of those perspectives (Catalano & Hawkins, 1996; Thornberry & Krohn, 2005). These theories have been selected for three reasons. First, and most importantly, they explicitly purport to be general theories of deviant behavior, including drug use, that should apply similarly across type of behavior, time, and place. The lack of ambiguity concerning their generality is appealing because if results are not similar across generations, the conclusion regarding this key assertion will also be unambiguous. Second, the explanatory variables that comprise these theories are among the most important risk and protective factors for drug use (Hawkins, Catalano, & Miller, 1992; Loeber & Stouthamer-Loeber, 1986; Smith, Lizotte, Thornberry, & Krohn, 1995). Third, the theoretical domains that comprise these theories—i.e., family, school, beliefs (or definitions), and peers—are of central importance to almost all social psychological theories of drug use. Therefore, by focusing on these concepts we will be able to examine not only how these specific theories relate to drug use across the generations but also, by extension, how central causal processes inherent in most social psychological theories relate to drug use. As these theories are quite well-known, we review them only briefly here.

Social Control Theory

The main premise of social control theory is that individuals are naturally attracted to pleasure, self-interest, and deviant behaviors. Therefore, theory needs to answer the question of why people do *not* commit such behavior rather than to address the question of what motivates them to do so. Hirschi (1969) answers that question by stating that we are constrained from deviant behaviors such as drug use by being tied or bonded to conventional society. The weakening or severing of the social bond frees individuals from constraint and places them in a position where they can (but not necessarily will) engage in drug use and related deviant behaviors.

More specifically, Hirschi (1969) identified four elements of the social bond which, when strong, ought to constrain adolescent drug use. The four elements are attachment to others, commitment to conventional lines of action, involvement in conventional activities, and belief. *Attachment* refers to the affective relationships that one has with other people. The theory focuses on the parent-adolescent relationship, suggesting that the stronger the attachment between adolescents and their parents, the lower the probability of adolescent drug using behavior. When attachment is strong, the adolescent is likely to take parental views into account before acting and, therefore, the likelihood of drug use is reduced. The second element of the social bond is *commitment* to conventional lines of action. People who desire to achieve conventional goals are likely to refrain from drug use since such behavior may jeopardize both the pursuit of those goals and investments already made. In particular, many conventional goals require education and, therefore, school becomes of paramount importance to youth. Commitment to school is hypothesized to decrease the probability of drug use. The related concept of *involvement* in conventional activities can be thought of as representing the time dimension of commitment (Kubrin, Stucky, & Krohn,

2009) suggesting that youth who spend a substantial amount of time in conventional activities will not have the time to engage in using drugs. The final element of the social bond is *belief*. Adolescents who believe in the moral validity of the law and the right of their parents to set rules are less likely to use drugs and engage in other problem behaviors while holding those beliefs. These four elements of the social bond are expected to act in an additive fashion; the weaker these four elements are, the more likely it is that drug use will occur.

Social control theory has generated a substantial amount of empirical testing (Greenberg, 1999; Kempf, 1993). Indeed, one of the initial appeals of the theory was that Hirschi (1969) not only articulated the theory but, using Richmond Youth Study data, found support for relationships between delinquent behavior and attachment, commitment, and belief. A number of cross-sectional studies have found one or more of the elements of the social bond also to be effective in explaining illicit drug use (e.g., Krohn & Massey, 1980; Marcos & Bahr, 1988; Wiatrowski, Griswold, & Roberts, 1981). The effect of attachment and commitment to school have been found to have important direct and indirect effects on drug use (Bahr, Hoffman & Yang, 2005; Ford, 2005; Hawkins et al., 1992; Vakalahi, 2001). While cross-sectional relationships are evident, longitudinal research examining the impact of social bonding variables on drug use has found much weaker support for the theory (Agnew, 1985; 1991; Elliott, Huizinga & Ageton, 1985; Paternoster & Iovanni, 1986).

Some scholars have suggested that the relatively weak support for the theory may be due to its failure to include a motivational component (Kubrin et al., 2009). That is, social control theory suggests that the weakening of the social bond releases individuals from constraints allowing for deviant behavior but it does not indicate why some less constrained individuals commit deviant behavior while others do not. Often, variables that are the province of social learning theory are suggested as necessary additions to social control theory.

Social Learning Theory

Social learning theories emanate from the work of Skinner (1951) and Bandura (1977). One of the most influential statements of social learning theory that focuses specifically on problem behaviors was developed by Akers (1998) who combined Sutherland's criminological theory of differential association (1939) with the principles of operant conditioning as developed by Skinner (1951) and Bandura (1977). Its major premise is that drug use, as all behavior, is learned, determined by the consequences (and anticipated consequences) of the behavior. Akers includes four major constructs in his theory: differential association, definitions, imitation, and differential reinforcement.

The most important of the four constructs is differential association. *Differential association* refers to the people with whom the actor is most likely to interact and their importance to the actor. These people, through their actions and attitudes, increase or decrease the likelihood of the actor's drug use. Differential association is also important because it defines the main context in which the actor may observe others engaging in drug using behaviors (*imitation*), encounter a stimulus that increases the probability of the response in the future for continued drug use (*differential reinforcement*), and acquire *definitions* or attitudes favorable to drug use. Each of these constructs is expected to be directly related to the onset of drug use.

Research on social learning theory has found that the core concepts associated with the theory are strongly related to drug use (Akers & Lee, 1996; 1999; Ellickson & Hays, 1992; Johnson, Marcos, & Bahr, 1987; Pratt et al., 2010). Differential association with delinquent peers is one of the strongest and most consistent correlates of drug use among adolescents (Brooks, Magnusson, Spencer, & Morgan, 2012; Marcos, Bahr, & Johnson, 1986; Pratt et al., 2010). In a study comparing social control and differential association theories, Marcos and her colleagues (1986) were able to show that differential associations with delinquent peers was the strongest predictor of adolescent drug use.

Longitudinally, social learning has also received support, though the main effects appear to be slightly weaker (Pratt et al., 2010). Akers and Lee (1996; 1999) conducted two longitudinal panel studies of 7^{th} to 12^{th} graders, finding in each study that age-graded social learning variables closely corresponded to age development of cigarette smoking (Akers & Lee, 1996) and marijuana use (Akers & Lee, 1999).

As noted by Pratt and colleagues (2010), the impact of definitions favorable to deviance has not been as well studied or supported in the literature as differential association; however, notable studies find that peer (Iannotti, Bush, & Weinfurt, 1996), and to a smaller extent parental, attitudes about drug use (Bahr et al., 2005) have a significant impact on adolescent drug use. Similarly, differential reinforcement has not garnered the same strong support as differential association in the research (Pratt et al., 2010). Pratt et al. (2010) suggest that the main effects of reinforcement are relatively modest and are generally overshadowed by other social factors such as definitions and peer associations (Pratt et al., 2010). Yet, Krohn and colleagues showed that differential reinforcement played a key mediating role in accounting for drug use in two different panel studies (Krohn, Lizotte, Thornberry, Smith, & McDowall, 1996; Krohn, Skinner, Massey, & Akers, 1985).

Overall, there is strong support for the major hypotheses derived from the social learning perspective. However, social learning theory does not explain why some individuals differentially associate with drug users or deviant groups in the first place. This is a gap that social control theory has the potential to fill. As Marcos and Bahr (1988) suggest, the combination of social control with social learning variables has been realized in theories that we refer to as integrated or elaborated theories. These theories provide the opportunity for a more complete and comprehensive understanding of the onset of drug use.

Elaborated Theories

Both the social development model (Catalano & Hawkins, 1996; Hawkins & Weis, 1985) and interactional theory (Thornberry, 1987; Thornberry & Krohn, 2005) offer more comprehensive theories of drug use and related problem behaviors that combine elements of control and learning theories. Both are developmental, life course theories that present causal models that vary by developmental stage. We focus on their theoretical models for early to mid-adolescence.

In the social development model (Catalano & Hawkins, 1996), attachment and commitment to prosocial institutions—especially family, peers, and school—increase belief in prosocial values and that, in turn, is hypothesized to have a direct impact on reducing drug use and

delinquency. In contrast, attachment and commitment to antisocial influences, both directly and indirectly via belief in antisocial values, increase the likelihood of drug use and delinquency. In other words, the social development model posits two major developmental pathways that account for the onset of drug use: prosocial attachments and commitments serve as protective factors to ward off involvement in drug using behavior while antisocial attachments, commitments, and beliefs serve as risk factors to increase the likelihood of drug use.

In interactional theory (Thornberry, 1987), prosocial influences (attachment to parents, commitment to school, and belief in conventional values) and antisocial influences (association with delinquent peers and delinquent values) are reciprocally related, mutually influencing each other over time. Weak prosocial bonds interacting with strong antisocial influences are hypothesized to lead to developmental trajectories that greatly increase the likelihood of adolescent drug use. In particular, during early adolescence the most potent influences on drug use and related problem behaviors are hypothesized to be low attachment to parents, low commitment to school, and association with deviant peers.

A number of studies have examined some form of an elaborated social control/social learning model. Elliott et al. (1985) indicated that delinquent peers have a direct effect on drug use, as well as being a significant mediator of control theory variables. Using a cross-sectional sample of 768 adolescent students, Johnson et al. (1987) were able to show that some social control factors, in tandem with differential association with delinquent peers, were able to explain 49% of the variance in drug use. Menard and Elliott (1994) obtained similar findings in their re-examination of the National Youth Study. The most direct and successful tests of an elaborated social development theory come from the Social Development Research Group that used longitudinal panel data from the Seattle Social Development Project. These studies consistently show support of the social development model, emphasizing the importance of commitment to school and delinquent peers in explaining individual drug use behavior (Hawkins et al., 1992; Hawkins & Weis, 1985). Similarly, studies with the Rochester Youth Development data also support elaborated theories of drug use. Evaluating peer influence on adolescent drug use, Krohn et al. (1996) showed both selection and socialization effects, findings that mirrored those in a more general test of interactional theory (Thornberry, Lizotte, Krohn, Farnworth, & Jang, 1991).

Overall, empirical explorations of elaborated models that combine social control and social learning variables agree on the utility of doing so. Most studies show that both prosocial influences and antisocial influences play a role in accounting for drug use and that models including indicators from both of these developmental domains provide a fuller explanation than models that focus exclusively on one or the other (Bahr et al., 2005; Hawkins et al., 1992; Vakalahi, 2001).

All of these theories—control, learning, and elaborated models—purport to be general explanations of behavior. In the remainder of this paper we test this assumption with a particular focus on intergenerational similarity. Given the centrality of these concepts to many theoretical models of deviant behavior and their role as basic risk and protective factors for adolescent problem behaviors (Hawkins, Von Cleve, & Catalano, 1991; Loeber &

Stouthamer-Loeber, 1986), we believe that our empirical results have broader application than just to these theories. At the same time, we recognize that these theories do not provide a complete explanation for adolescent drug use. For example, there is considerable evidence that substance use is influenced by genetic endowments (Polderman et al., 2015). Nevertheless, as the primary purpose of this investigation is to see if these core social psychological theories of substance use generalize across generations, we will limit our investigation to the explanatory variables contained in control and learning theories. We also recognize that we are not establishing causal relationships in this analysis. Instead, we are examining the extent to which important antecedents of adolescent substance use as predicted by control, learning and elaborated theories operate in the same manner across generations. Assuming that they do, the investigation of whether or not these relationships are causal would require much greater attention to issues of a selection and spuriousness as well as other analytic approaches, such as the use of the propensity score models. Our purpose is more simple, namely to examine the generality of these theoretical approaches.

Prior Intergenerational Research

In recent years there has been an increase in the availability of data sets that include similarly measured variables for different generations of respondents (e.g., Bailey et al., 2006; Capaldi et al., 2012; Conger et al., 2003). Much of the work with these data has focused on establishing the level of intergenerational continuity in problem behavior (e.g., Besemer & Farrington, 2012; Kerr, Capaldi, Pears, & Owen, 2012; Knight, Menard, & Simmons, 2014) and, once a relationship is established, identifying the mediating mechanisms or processes that help explain it (Bailey, Hill, Oesterle, & Hawkins, 2009; Conger et al., 2003; Thornberry, Freeman-Gallant, Lizotte, Krohn, & Smith, 2003; Thornberry, Freeman-Gallant, & Lovegrove, 2009). But, as suggested above, there has been very limited research on another intergenerational question: whether theoretically relevant variables are similarly related to the same outcome in different generations separated by time. Johnson et al. (2012) stated that there were no published studies that directly compared causal models between generations, a conclusion also reached earlier by Kaplan and Liu (1999).

Although these theories propose that they are based on general social psychological processes that apply across time, there is a counterargument that the explanation of substance use will be affected by secular changes in society. Indeed, the relative dearth of studies examining the intergenerational generality of social control and social learning theories is somewhat surprising given the potential impact of changes in relations between youth and their parents and their friends that can occur from one generation to the next. For example, in the present case, the increased ease in using social media as a means of communication raises the possibility that parents and their children will have different and somewhat less intimate relationships and patterns of communication (Kraut et al., 1998). Also, social media may change the nature and source of the friends that children have, the type of influences those friends have on behavior, as well as the ability of parents to monitor with whom their children interact. Technological advances have also facilitated the acquisition of information on myriad subjects enabling today's youth to be exposed to values beyond those of parents and peers (O'Keefe & Clarke-Pearson, 2011). It is also

possible the increased pressure on obtaining a job has impacted the relative importance of being committed to school. Whether these changes have impacted the influence of parents and peers on youth behavior, and thus affect the claim of generality across generations shared by theories examined herein, is an important question that has received very limited attention. Indeed, we could find only three studies that directly addressed this issue, only one of which examined substance use as an outcome.

Menard and Johnson (2015) used data from the National Youth Survey and investigated intergenerational similarity for three substances—alcohol use, marijuana use, and hard drug use. Focusing on the direct effects of the theoretical variables, there is a good deal of intergenerational similarity for social learning theory. In both generations, delinquent peers and deviant beliefs are significantly related to each of the three substances. There is less similarity for social control theory variables, however. Family involvement is significantly related to marijuana use for the original generation of respondents, but not to alcohol or hard drug use. None of the other bonding variables they investigated are related to any of the three substances. For the next generation however, family involvement is significantly related to alcohol use, and school strain is significantly related to both marijuana use and hard drug use.

In general, Menard and Johnson (2015) found some consistency across the generations especially in the core predictors derived from a social learning perspective. In both generations, delinquent peer group bonding and deviant beliefs are the strongest predictors of the outcomes. At the same time, they found two important differences. The effect of gender on drug use was not significant for the more recent generation whereas it had been for the original sample. They suggest that this might have been due to increasing gender equality. The second concerns school strain. For the more recent generation, school strain plays a direct role in predicting deviant outcomes whereas it only had an indirect impact for the original sample. Menard and Johnson speculate that children may now feel greater pressure regarding school from their parents than they did in the past.

The other two studies of this issue focus on delinquent behavior as the primary outcome.[1] Farrington et al. (2014) used data from the Cambridge Study in Delinquent Development to examine if G1 risk factors for G2 male offending were similar to G2 risk factors for G3 male offending. The study included variables measuring parental risk factors such as criminal history; family factors such as discipline, supervision, and conflict in the home; socioeconomic factors such as income, size of family, and type of housing; attainment factors such as test scores and leaving school early; impulsiveness such as risk taking and impulsivity; and behaviors such as dishonesty and suspension from school. Their findings indicated that eight risk factors were significant predictors of both G2 and G3 offending. These included conviction of father or mother, poor parental supervision, having a disrupted family, low family income, poor housing, low attainment, and daring/risk-taking behavior. Another set of five risk factors were differently related to offending across the two generations.

[1]Menard and Johnson (2015) also examined two indicators of delinquent behavior with results similar to those just summarized.

Due to the design of the Cambridge study, the samples and data from the two generations are not identical and a number of the constructs were measured with different variables. G2 risk factors were measured when they were 8–10 years old while the risk factors for G3 were measured when G3 was older. Given these differences, it is notable that Farrington et al. (2014) found that eight variables were significant for both generations.

Johnson et al. (2012) used the National Youth Survey to explore whether results vary across the generations in an examination of a theoretical model combining general strain theory with social learning and social control variables. Strain variables (negative life events, traditional strain, negative relations with adults, victimization, and peer problems) are antecedent to social control and social learning variables, although all variables are hypothesized to have direct effects on delinquency. Overall, the model operated similarly for both generations. Estimating a structural equation model for the two generations they found that "only two out of nine direct effects on delinquency (negative life events and peer problems) failed to match in significance and direction of relationship" (Johnson et al., 2012, p. 14–15). Peer problems were inversely related to delinquency for the second generation, a finding contrary to the predicted direction. The greater effect size of negative life events for the original respondents is attributed to the possibility that certain negative life events (e.g., divorce) may not have the saliency they once did.

The findings from these studies lend themselves to different interpretations. On the one hand, there is overall similarity across generations; however, there also are important differences for some of the variables included in the analyses. It is difficult to resolve the ambiguity of these findings, in large part because of the dearth of investigations that compare theories across generations. The authors of the above studies clearly recognize this limitation and all agree that further research is necessary (Farrington et al., 2014; Johnson et al., 2012; Menard & Johnson, 2015). Thus, the present study examines the extent to which social control, social learning, and elaborated theories, all of which purport to be general theories of problem behaviors, produce similar results across two adjacent generations of the same families observed at similar ages. Specifically, we offer the following hypotheses:

1. Bivariate relationships between social control and social learning theory variables and adolescent drug use will be of similar direction, magnitude and relative importance for both generations.
2. The findings regarding the processes specified by control, learning, and elaborated theories of drug use will yield similar substantive understandings concerning the origins of adolescent drug use across the generations.

More generally, we are hypothesizing that there will not be strong secular trends evident in the data and that core risk and protective factors will be similar for the two generations.

Methods

To test these hypotheses we use data from the Rochester Youth Development Study (RYDS) and the Rochester Intergenerational Study (RIGS). These companion longitudinal studies are

based on a community sample designed to investigate the origins and consequences of drug use and related problem behaviors.

Sampling

The original study, RYDS, began in 1988 with a probability sample of 1,000 adolescents from Rochester, New York, a city with high rates of crime, poverty, and distressed neighborhoods. The sample is based on the public school population of all 7th and 8th graders as of 1988, selected so that a) youth at risk for problem behaviors are overrepresented and b) the findings can be weighted to represent the full cohort. Overrepresentation of high risk youth was accomplished by disproportionately stratifying on gender (75% males) and proportionately stratifying on residence in high-crime areas (Krohn & Thornberry, 1999). These stratifying variables are included as control variables in all analyses reported below. The RYDS sample was interviewed 14 times from age 14 to 31. A parent (G1) was also interviewed 11 times (until G2 was 23). The sample is 68% African American, 17% Hispanic, and 15% White.

In the present analysis we use data from the adolescent phase of the study, up to Wave 7, for which there was 90% retention. Comparisons of retained and non-retained G2 participants show that those retained were still representative of the original sample (Thornberry, 2013). During this phase of the study, interview data were collected from the adolescents and their parents at six-month intervals.

The intergenerational study, RIGS, began in 1999 to examine intergenerational continuity and discontinuity in problem behaviors. The G3 focal subjects are the oldest biological children of the original G2 RYDS participants. In Year 1 we enrolled children age 2 or older (average age = 6) and in each subsequent year we enrolled first-born children as they turned 2. By project Year 15 (2013), there were 624 eligible G3 children: 192 of RYDS mothers and 432 of RYDS fathers. 97% of the families of RYDS mothers (186 of 192) participated in the study. Although less than half of G2 fathers lived with the G3 child, 79% (343 of 432) enrolled in the study. Participating and non-participating fathers do not differ significantly by such variables as G2 adolescent drug use and delinquency, race/ethnicity, age at the birth of G3, high school dropout status, or history of maltreatment. Retention has been high; 88% (n = 465) were retained at Year 15. Retention at Year 15 does not differ for the children of G2 fathers vs. G2 mothers (88% for both).

In the RIGS all G2 fathers and G2 mothers (these are not couples, just the original male and female RYDS participants), G3 children age 8 and older, plus G3's other major caregiver (OCG) were interviewed. The OCG is the person who, in addition to G2, is primarily responsible for raising G3. For G2 father families, this is usually the G3 child's biological mother (93%); for G2 mother families, the OCG includes grandmothers (47%), G3's biological father (31%), aunt (7%), stepfather (6%), or other (9%).

Comparability of the generations—To compare the theoretical models across generations, we attempted to make the two samples as similar as possible within the limitations imposed by the two study designs. First, we selected G2 and G3 participants who were approximately the same ages. We chose middle adolescence, roughly 14 to 16 years of

age. To ensure proper temporal order for examining G2 drug use, predictor variables are drawn from Wave 2 when the mean age is 14.5. Because the G2 participants were interviewed at 6-month intervals, we use data from interview Wave 4 (average age 15.5 and whose self-report recall period begins at approximately age 15) through Wave 7 to measure drug use at ages 15 and 16. A maximum of 914 G2 participants are available for analysis although there is some additional missing data for individual variables (see Table 1).

RIGS data are collected annually, close to the G3's birthday. In examining G3 drug use, predictor variables are measured at the age 14 interviews. The cumulative drug use variable is measured by combining reported use at the ages 15 and 16. Given the wide age range of G3 participants, we include all G3 participants who were interviewed at ages 15 and 16. Many of the G3 sample were not yet interviewed at ages 15 and 16, thus, a maximum of only 311 G3 participants are available for this analysis. This is the closest match of age groups between G2 and G3 that is currently available.

Second, 95% of the parent respondents in the original RYDS are mothers. In the RIGS we included the families of both G2 mothers and G2 fathers. To make the parental measures more comparable, we use data reported by G3's mother. For G3 children from the G2 mother families, we use the G2 report; for G3 children from the G2 father families, we use the other caregiver report which is almost always the child's biological mother. Thus, virtually all of the parental measures in both generations are based on maternal data.

Third, the G3 sample includes individuals who will and will not eventually become parents. Because of that, in the analysis of G2 adolescent drug use we include the full G2 sample and not just G2s who are parents in the intergenerational study. We compared the G2 parents and G2 non-parents on all of the study variables; the two groups are not significantly different on any of these variables.

There are two design differences that we cannot address directly. First, the G2 sample is 75% male and the G3 sample is 50% male. Because of this, we control for G2 gender in all of the analysis reported below and we discuss potential gender differences where appropriate. Second, the G3 adolescents are somewhat more likely to be the children of parents who began child bearing at younger ages than are the G2 adolescents. In the models for G3 drug use we additionally control for G3 gender and G2 age at first birth.

Measurement

In general, the measures that were used in the two studies—RYDS and RIGS—are quite comparable, as the RIGS measures were based on existing RYDS scales and indexes. There are some minor changes in wording for the RIGS measures based on our previous experiences in using them in the RYDS project. To conserve space we only describe the theoretical variables that are used in predicting G2 outcomes; any major differences between these measures and those used for predicting G3 outcomes are noted in the text. Also, the exact measures that were used in these analyses are presented in Appendix A.

Drug use—At each interview we asked the G2 respondents a 10-item self-report index and the G3 respondents a 9-item self-report index measuring the use of marijuana and other

illicit drugs: inhalants, hallucinogens, cocaine, crack, tranquilizers, heroin, PCP, downers, and uppers (See Appendix A for the actual items). For each generation the measure of *self-reported drug use* is based on adolescent self-reports that refer to use at approximately ages 15 and 16. It is a dichotomous measure reflecting the prevalence of illicit drug use at these ages. For the G3 participants, the incidence of use was too low to generate frequency of use measures, largely because of the relatively small sample size (311). We therefore focus on the dichotomous measure of prevalence in each generation for which there is ample data.

Control theory measures—Three of the four central concepts from Hirschi's (1969) version of control theory are available in the Rochester data. The first is measured in the G1 parent interviews and the second two in the G2 adolescent interviews. (For explaining G3 drug use, the comparable measures are drawn from the G2 parent interviews and G3 adolescent interviews.) *Attachment to child* is an 11-item adaptation of the Child's Attitude Toward Parent scale (Hudson, 1996) in which the parent—recall the respondents are overwhelmingly mothers—reports her perception of the degree of warmth and lack of hostility in the parent-child relationship (α = .81). A 10-item scale, *commitment to school*, measures the adolescent's interest and involvement in schoolwork (α = .81). Finally, involvement in *conventional activities* is a count variable indicating the adolescent's participation in activities such as organized sports, clubs, musical groups, and religious activities. The range is from 0 to 4.

Learning theory measures—Four variables derived from social learning theory (Akers, 1998) are also considered. The first three are measured by adolescent reports. *Peer drug use* is based on the adolescent's report of how many of their friends used any of the following 4 different types of drugs: alcohol, marijuana, crack, and hard drugs. *Risky time with friends* is based on the adolescent's report of how much time they spend with friends "hanging out" without adults being present and supervising them (α = .77). This is a 3-item scale for G2 and a 5-item scale for G3. *Deviant beliefs* is an 11-item scale asking the adolescent to rate how wrong it is to engage in problem behaviors such as stealing, using a weapon, and joyriding (α = .84).

Finally, to reflect the concept of imitation, parent marijuana use is measured. In this case measurement is somewhat different across the generations. The G1 parents were asked if they had ever used marijuana and, if so, if they currently used. The latter, binary indicator (combined for Waves 2 and 3 to generate an annual estimate) is used when analyzing G2 drug use. In the RIGS the G2 parents were asked the basic self-reported drug use inventory described earlier and the measure used in the current analysis indicates whether or not they used marijuana in the past year.

Analytic Plan

Our empirical strategy is to compare parallel sets of coefficients for models of G2 outcomes with those for G3 outcomes. We begin with descriptive statistics of the variables used in our study and the simple bivariate odds ratios to examine if risk and protective factors have similar relationships for adolescent drug use across the generations. We then move to the core of this investigation and estimate logistic regression models testing each of the three

theories. In this step, to extend the analyses of earlier papers (e.g., Farrington et al., 2014; Menard & Johnson, 2015), we formally compare the signs and magnitudes of the coefficients for each of the predictors across the generations. We test the null hypothesis H_0: $\beta_{(G2)} = \beta_{(G3)}$ for each individual predictor by calculating χ^2 statistics for the test of equality of the coefficients. Specifically, failure to reject the null hypothesis would indicate that we are unable to find sufficient evidence of different relationships across the two generations.

Results

Descriptive Statistics

Descriptive statistics for all study variables are reported in Table 1, with variables for the G2 analyses in the left panel and G3 analyses in the right panel. The prevalence of drug use is somewhat less for G3 as compared to G2: 23% of the G2 adolescents self-report drug use while 17% of the G3 adolescents do. Although drug use is somewhat lower for G3, the difference between these means represents only .15 of the respective pooled standard deviations, suggesting general similarity across generations. Given the different gender distributions for G2 and G3 we also examined changes in the outcome variables across generations within gender. For both males and females there is a decline in the level of drug use from the second generation to the third generation. The lower prevalence rates for G3 could also be influenced by the fact that they are, on average, somewhat younger than the G2 participants.

The lower panel of Table 1 presents information on the seven theoretical variables. Overall, the average level of these risk and protective factors are quite comparable across the generations, as in all cases the 95% confidence intervals for either generation overlap. The largest discrepancy is observed for parent reports of marijuana use which increases from 5% of the G1 parents to 13% of the G2 parents. This is not surprising as the measure of parental marijuana use (but not child marijuana use) is somewhat different in the two generations; the G1 parents were asked about “current” use as part of a brief assessment of their substance use while the G2 parents were asked about their use of marijuana during the past year as part of the full self-reported drug use index. It is also interesting to note that the reliabilities across the four theoretical measures that are scales are also quite comparable. In general, there does not appear to be large secular trends in the level of risk and protective factors in the lives of the G2 adolescents compared to the G3 adolescents, or in their psychometric properties.

Bivariate Relationships

The central question of this investigation is: do these purportedly general theories of problem behavior offer comparable explanations of adolescent drug use for both generations? We start by examining precursors for the prevalence of drug use (Table 2) presenting the results as odds ratios. Several general observations about the comparability of results across the generations can be made. First, all of the odds ratios are statistically significant ($p < .05$) for each generation. Second, the direction of the odds ratios are identical in both generations and in the theoretically expected direction; all of the bonding theory variables are protective against drug use and all of the learning theory variables are

risk factors for drug use. Third, the relative magnitude of the comparable odds ratios are similar for both generations.

Overall, for these seven risk and protective factors there is no evidence that their bivariate relationships with drug use operate in a substantially different manner for these two generations. Indeed, the weight of the evidence suggests that they are quite comparable, suggesting that substantive conclusions would be the same whether based on a G2 or G3 analysis.

Regression Models

In the final step in the analysis we estimate three sets of logistic regression models that reflect learning, control, and elaborated theories, respectively. For each theory, we fit two separate models for drug use, one for G2 and another for G3. G2 gender and neighborhood arrest rate, the stratifying variables, are included as controls in each model specification. In addition, G3 gender and G2 age at first birth are included as controls in the models for G3 drug use. In no case is there a significant association of any of the control variables on the outcomes. Finally, we compare the signs and magnitudes of the coefficients for each of the predictors across the generations and formally test whether or not they are significantly different from each other. Specifically, we test the null hypothesis H_0: $\beta_{(G2)} = \beta_{(G3)}$ for each individual predictor, using a standard difference-in-coefficients test. For each comparison, we report χ^2 statistics for the tests of equality. Failure to reject the null hypothesis indicates that we are unable to find sufficient evidence of different relationships across the two generations for the specific predictor.

Results for social learning theory are presented in the top panel of Table 3. First, we note that all relationships are positive and in the expected direction. For either generation, spending unsupervised or risky time with friends and perceptions of peer drug use are each statistically significantly related to drug use ($p < .05$). Parent marijuana use is also significantly related to adolescent drug use, but only for G3. Conversely, deviant beliefs are significantly related to adolescent drug use, but only for G2. Importantly for our core hypothesis, the equality of coefficients tests reveal that none of these pairs of coefficients are significantly different from one another across the two generations.

The results for control theory are reported in the middle panel of Table 3. Commitment to school is the only predictor significantly related to drug use for both generations. In fact, this is the only predictor which significantly predicts G3 drug use. Parental attachment and conventional activities each significantly reduce drug use for G2, but not for G3. Once again, however, the equality of coefficients tests reveal that none of these pairs of coefficients are significantly different from one another across the two generations, providing support for our main hypothesis.

Lastly, we consider a set of regressions for elaborated theories which reflect the combination of control and learning influences on drug use. In these regressions, we include all seven variables used in the previous analyses. The results are presented in the bottom panel of Table 3. First, in both generations, two learning theory variables—peer drug use and risky time with friends—are significantly related to drug use. A third learning theory variable,

parent marijuana use, is a significant predictor for G3, though not G2. Second, the control theory measures are less consistently related to drug use. Conventional activities is a significant predictor of drug use for G2 though not for G3. Conversely, commitment to school significantly predicts drug use in G3 but not G2. Third, we tested the equality of coefficients across generations for the seven pairs of predictors and none was statistically significant ($p < .05$), once again suggesting a great deal of similarity across generations.

Discussion

Many theories of adolescent problem behaviors, including drug use, offer general explanations of the outcome. That is, the causal mechanisms they identify are expected to hold across groups, time, and place. That is certainly the case for the theories investigated here—social control theory, social learning theory, and elaborated theories. They are expected to offer equally valid explanations of drug use across major subgroups of the population such as gender (Booth et al., 2008) and race/ethnicity (Cernkovich & Giordano, 1992). They are also expected to offer equally valid explanations of delinquency across generations. Three-generational studies offer an ideal setting in which to test this hypothesis. Yet, there are very few empirical assessments of the extent to which these theories are, in fact, comparable in adjacent generations.

The present study, therefore, investigated this issue using data from the Rochester Intergenerational Study. In particular, we considered predictors of adolescent drug use given its long-term negative consequences for the individual and for society (Odgers et al., 2008). We first examined seven risk and protective factors derived from these theories to see if they were related to adolescent drug use in both the parent generation (G2) and the child generation (G3). Second, we examined regression models derived from social control theory (Hirschi, 1969), social learning theory (Akers, 1998), and elaborated or integrated theories (Catalano & Hawkins, 1996; Thornberry, 1987), to see if they are comparable across the generations and, in this case, formally tested the equality of pairs of coefficients across generations.

Overall, the results of this investigation appear to offer evidence for the generality of these theoretical approaches. Bivariate relationships are quite comparable across the generations; bonding variables are protective against drug use and learning theory variables are risk factors for drug use. Although the results are not identical, the same substantive conclusions about bivariate relationships with drug use would be drawn whether one looked at the G2 analysis or the G3 analysis.

The results of the regression analysis, in which we formally tested the equality of the pairs of coefficients, also support a conclusion of similarity, although they are not quite as clear-cut. First, across the three different theoretical models, none of the 14 tests for differences between pairs of corresponding coefficients was significant at $\alpha=.05$. This suggests that a great deal of similarity is operating across the two generations, a necessary condition for the generality of these theories. These observations are consistent with previous studies that have examined the level of intergenerational similarity in predictors for various problem behaviors across the generations. For example, Farrington et al. (2014), using data from an

English sample, and both Johnson et al. (2012) and Menard and Johnson (2015) using the National Youth Study data, find substantial, but not universal, similarity in risk and protective factors across adjacent generations.

Second, we also found some notable differences between the generations, especially regarding the social control theory variables. For G2 participants, all three variables were significant in the control theory analysis and conventional activities remains significant in the elaborated theory analysis. In contrast, in the analysis of G3 adolescent drug use, the only social control theory variable that was significant was commitment to school. Differences for the social learning theory variables are somewhat more muted. The most obvious difference concerns parental marijuana use which is more consistently related to G3 drug use than it is to G2 drug use. This could be a generational difference or it could be influenced by the somewhat different measurement strategies used for that particular variable (see Methods). Overall, these findings of differences are reminiscent of the results reported by Menard and Johnson (2015). They also found more differences across the generations for social control theory variables than social learning theory variables. In addition, they also report that variables related to schooling appear to be more important for the G3 generation than for the G2 generation. Interestingly, the Menard and Johnson (2015) study is the only other study that focuses specifically on drug use.

In general, while there are differences in which specific variables are significantly related to drug use across adjacent generations in the multivariate models reported here, the overall weight of the evidence seems to support the core hypothesis that these theories offer general explanations for drug use. That is the case for the bivariate relationships (see Table 2) which are identical in direction and similar in magnitude in the two generations. It is also the conclusion from the tests examining the equality of coefficients across the two generations, none of which is statistically significant. If replicated in other intergenerational studies, these findings have important theoretical and policy implications.

First, with respect to theory, the current findings indicate that the causal processes identified in the three theoretical orientations examined here are likely to be fundamentally important predictors of a range of adolescent problem behaviors such as drug use. As hypothesized by control theory, adolescents who are more strongly bonded to conventional society, as represented here by links to parents and school, are less likely than their counterparts to become involved in drug use. As hypothesized by learning theory, adolescents who are exposed to deviant role models and deviant beliefs are more likely than their counterparts to become involved in drug use. And finally, as hypothesized by elaborated models, these processes are not mutually exclusive, both contribute to our understanding of drug use. Overall, there is a good deal of support for the core hypothesis of this investigation—that these theories operate similarly in adjacent generations.

Although there are strong similarities in how these theories operate across the generations as noted above, there are also some observed differences. An important task for future research is to determine which of these differences appear to be more fleeting, generated perhaps by methodological changes in sampling and measurement, and which differences are more substantive, reflecting real secular change.

Second, these findings have important implications for policy and program development. If there were, in fact, substantial differences in causal relationships across the generations it would be difficult to base broad policy and programmatic recommendations upon them. That is, if causal linkages are highly specific to generations, then prevention and treatment programs would have to be constantly changing and tailored to each generation's salient influences. That would be exceedingly difficult to accomplish given the length of time it takes to translate basic research findings into programmatic content and then the length of time it takes to scientifically evaluate prevention and treatment programs to identify evidence-based programs (Mihalic, Fagan, Irwin, Ballard, & Elliott, 2002). Fortunately, the present findings suggest that such an approach is not necessary, at least across adjacent generations. The causal processes identified here appear to have consistency and can be used to form the backbone of prevention and treatment programs as they do with such evidence-based programs as Life Skills Training (Botvin, Baker, Botvin & Diaz, 1995), Functional Family Therapy (Alexander & Robbins, 2011), and Multisystemic Therapy (Henggeler, Schoenwald, Borduin, Rowland, & Cunningham, 2009).

That is not to say that the causal processes identified here are universal and unchanging. Some of them may change—and some of them may be more susceptible to period effects than others (see Menard & Johnson, 2015)—but that change appears to play out over longer historical periods. Both theory and policy need to be sensitive to this possibility and three-generational studies need to continue investigating this issue. At the same time, however, based on this and related research (Farrington et al., 2014; Johnson et al., 2012), there do seem to be some general causal influences at work in the explanation of adolescent problem behaviors.

As with all studies, the present one has some important limitations. First, it is obviously a single study based on a single sample and this issue requires replication in other intergenerational studies. The sample is comprised of a disproportionate number of African American males. Hence the generality of the finding is limited. This is a particularly salient issue in this case as there are only three prior studies that have directly examined this question and therefore there is a very slim body of scientific evidence to date. Second, we only examined risk and protective factors drawn from control, learning, and elaborated theories. There are other theoretical perspectives and other important risk and protective factors, and our results say nothing about whether or not those behave similarly across the generations. Extending this investigation to other theories is an important task for future research. Our research question focused on whether social and environmental factors are differentially related within the same families at different historical times. In doing so we did not examine the potential effects of genetic and family environmental factors. Research on substance use and abuse has found a strong correlation between certain genetic factors and drug use (Goldman, Oroszi, & Ducci, 2005; Kreek et al., 2005; Polderman et al., 2015). One would expect that if genetic factors are influential in explaining drug use, their effect would be consistent across generations.

Finally, we only examined theoretical similarity in adjacent generations. It would be desirable to extend that to multiple generations to expand the historical scope being investigated. Unfortunately, that will be exceedingly difficult to accomplish as there are very

few studies that extend beyond three generations *and* that have comparable information on problem behaviors as well as theoretically informed risk and protective factors. Nevertheless, it is an important challenge for future research.

Despite these and other limitations, we believe the present investigation extends our understanding of the central hypothesis. Most theories of drug use and related problem behaviors hypothesize, often implicitly, that their causal processes are generally applicable across time and place. For example, strong bonding to conventional institutions is hypothesized to reduce problem behaviors for all generations; association with deviant peers and holding deviant beliefs are hypothesized to increase problem behaviors for all generations. We tested these assertions using prospective data from adjacent generations assessed at the same developmental stage with comparable measures in the Rochester Intergenerational Study. Our findings are generally supportive of these assertions and suggest that for these core causal processes there is, indeed, some generality across time.

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References

Agnew R. Social control theory and delinquency: A longitudinal test. Criminology. 1985; 23:47–61.

Agnew R. A longitudinal test of social control theory and delinquency. Journal of Crime and Delinquency. 1991; 28:126–156.

Akers, RL. Social learning and social structure: A general theory of crime and deviance. Boston, MA: Northeastern University Press; 1998.

Akers RL, Lee G. A longitudinal test of social learning theory: Adolescent smoking. Journal of Drug Issues. 1996; 26:317–343.

Akers RL, Lee G. Age, social learning, and social bonding in adolescent substance use. Deviant Behavior. 1999; 20:1–25.

Alexander, JF.; Robbins, MS. Functional family therapy. New York, NY: Springer; 2011.

Allison PD. Comparing logit and probit coefficients across groups. Sociological Methods & Research. 1999; 28:186–208.

Bahr SJ, Hoffmann JP, Yang X. Parental and peer influences on the risk of adolescent drug use. The Journal of Primary Prevention. 2005; 26:529–551. [PubMed: 16228115]

Bailey JA, Hill KG, Oesterle S, Hawkins JD. Linking substance use and problem behavior across three generations. Journal of Abnormal Psychology. 2006; 34:263–282.

Bailey JA, Hill KG, Oesterle S, Hawkins JD. Parenting practices and problem behavior across three generations: Monitoring, harsh discipline, and drug use in the intergenerational transmission of externalizing behavior. Developmental Psychology. 2009; 45:1214–1226. [PubMed: 19702387]

Bandura, A. Social learning theory. Englewood Cliffs, NJ: Prentice Hall; 1977.

Besemer S, Farrington DP. Intergenerational transmission of criminal behaviour: Conviction trajectories of fathers and their children. European Journal of Criminology. 2012; 9:120–141.

Booth JA, Farrell A, Varano SP. Social control, serious delinquency, and risky behavior: A gendered analysis. Crime and Delinquency. 2008; 54:423–456.

Botvin GJ, Baker E, Botvin EM, Diaz T. Long-term follow-up results of a randomized drug abuse prevention trial in a White middle-class population. JAMA. 1995; 14:1106–1112.

Brooks FM, Magnusson J, Spencer N, Morgan A. Adolescent multiple risk behavior: An asset approach to the role of family, school and community. Journal of Public Health. 2012; 34:48–56.

Capaldi DM, Pears KC, Kerr DCR. The Oregon youth study three-generational study: Theory, design, and findings. The International Society for the Study of Behavioural Development Bulletin. 2012; 62:29–33.

Catalano, RF.; Hawkins, JD. The social development model: A theory of antisocial behavior. In: Hawkins, JD., editor. Delinquency and crime: Current theories. New York, NY: Cambridge University Press; 1996. p. 149-197.

Cernkovich SA, Giordano PC. School bonding, race, and delinquency. Criminology. 1992; 30:261–291.

Conger RD, Neppl T, Kim KJ, Scaramella LV. Angry and aggressive behavior across three generations: A prospective, longitudinal study of parents and children. Journal of Abnormal Child Psychology. 2003; 31:143–160. [PubMed: 12735397]

Daigle LE, Cullen FT, Wright JP. Gender differences in the predictors of juvenile delinquency: Assessing the generality-specificity debate. Youth Violence and Juvenile Justice. 2007; 5:254–286.

Ellickson PL, Hays RD. On becoming involved with drugs: Modeling adolescent drug use over time. Health Psychology. 1992; 11:377–385. [PubMed: 1286657]

Elliott, DS.; Huizinga, D.; Ageton, SS. Explaining delinquency and drug use. Beverly Hills, CA: Sage; 1985.

Farrington, DP.; Ttofi, MM.; Crago, RV.; Coid, JW. Risk factors versus offending in two successive generations of males. Paper presented at the meeting of the Life History Research Society; Pittsburgh, PA. 2014 May.

Ford JA. Substance use, the social bond, and delinquency. Sociological Inquiry. 2005; 75:109–128.

Gardner L, Shoemaker DJ. Social bonding and delinquency: A comparative analysis. The Sociological Quarterly. 1989; 30:481–499.

Goldman D, Oroszi G, Ducci F. The genetics of addictions: uncovering the genes. Nature Reviews Genetics. 2005; 6(7):521–532.

Greenberg DF. The weak strength of social control theory. Crime and Delinquency. 1999; 45:66–81.

Hawkins JD, Catalano RF, Miller JY. Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. Psychological Bulletin. 1992; 112:64–105. [PubMed: 1529040]

Hawkins JD, Von Cleve E, Catalano RF. Reducing early childhood aggression: Results of a primary prevention program. Journal of the American Academy of Child and Adolescent Psychiatry. 1991; 30:208–217. [PubMed: 2016224]

Hawkins JD, Weis JG. The social development model: An integrated approach to delinquency prevention. Journal of Primary Prevention. 1985; 6:73–97. [PubMed: 24271382]

Heimer K, De Coster S. The gendering of violent delinquency. Criminology. 1999; 37:277–318.

Henggeler, SW.; Schoenwald, SK.; Borduin, CK.; Rowland, MD.; Cunningham, PB. Multisystemic therapy for antisocial behavior in children and adolescents. New York, NY: Guilford Press; 2009.

Hirschi, T. Causes of delinquency. Berkeley, CA: University of California Press; 1969.

Hudson, WW. WALMYR assessment scales scoring manual. Tempe, AZ: WALMYR Publishing Company; 1996.

Iannotti RJ, Bush PJ, Weinfurt KP. Perception of friends' use of alcohol, cigarettes, and marijuana among urban schoolchildren: A longitudinal analysis. Addictive behaviors. 1996; 21:615–632. [PubMed: 8876761]

Johnson MC, Morris RG, Menard S. Historical invariance in delinquency causation: A test of equivalent models of delinquency for two generations of adolescents. Crime and Delinquency. 2012; Advance online publication. doi: 10.1177/0011128712446051

Johnson RE, Marcos AC, Bahr SJ. The role of peers in the complex etiology of adolescent drug use. Criminology. 1987; 25:323–340.

Junger M, Marshall IH. The interethnic generalizability of social control theory: An empirical test. Journal of Research in Crime and Delinquency. 1997; 34:79–112.

Kaplan, HB.; Liu, X. Explaining transgenerational continuity in antisocial behavior during early adolescence. In: Cohen, P.; Slomkowski, C.; Robins, LN., editors. Historical and geographical influences on psychopathology. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers; 1999. p. 163-191.

Kempf, KL. The empirical status of Hirschi's control theory. In: Adler, FA.; Laufer, WS., editors. New directions in criminological theory: Advances in criminological theory, Vol. 4, Advances in criminological theory. Piscataway, NJ: Transaction Publishers; 1993. p. 143-187.

Kerr DCR, Capaldi DM, Pears KC, Owen LD. Intergenerational influences on early alcohol use: Independence from the problem behavior pathway. Development and Psychopathology. 2012; 24:889–906. [PubMed: 22781861]

Knight KE, Menard S, Simmons SB. Intergenerational continuity of substance use. Substance Use and Misuse. 2014; 49:221–233. [PubMed: 23965041]

Kreek MJ, Nielsen DA, Butelman ER, LaForge KS. Genetic influences on impulsivity, risk taking, stress responsivity and vulnerability to drug abuse and addiction. Nature Neuroscience. 2005; 8:1450–1457. [PubMed: 16251987]

Kraut R, Patterson M, Lundmark V, Kiesler S, Mukophadhyay T, Scherlis W. Internet paradox: A social technology that reduces social involvement and psychological well-being? American Psychologist. 1998; 53:1017–1031. [PubMed: 9841579]

Krohn MD, Lizotte AJ, Thornberry TP, Smith CA, McDowall D. Reciprocal causal relationships among drug use, peers, and beliefs: A five-wave panel model. Journal of Drug Issues. 1996; 26:405–428.

Krohn MD, Massey JL. Social control and delinquent behavior: An examination of the elements of the social bond. Sociological Quarterly. 1980; 21:529–543.

Krohn MD, Skinner WF, Massey JL, Akers RL. Social learning theory and adolescent cigarette smoking: A longitudinal study. Social Problems. 1985; 32:445–473.

Krohn MD, Thornberry TP. Retention of minority populations in panel studies of drug use. Drugs & Society. 1999; 14:185–207.

Kubrin, CE.; Stucky, TD.; Krohn, MD. Researching theories of crime and deviance. New York, NY: Oxford University Press; 2009.

Loeber, R.; Stouthamer-Loeber, M. Family factors as correlates and predictors of juvenile conduct problems and delinquency. In: Morris, N.; Tonry, M., editors. Criminal justice: An annual review of research. Vol. 7. Chicago: University of Chicago Press; 1986. p. 29-149.

Marcos AC, Bahr SJ. Control theory and adolescent drug use. Youth & Society. 1988; 19:395–425.

Marcos AC, Bahr SJ, Johnson RE. Test of a bonding/association theory of adolescent drug use. Social Forces. 1986; 65:135–161.

Matsueda RL, Heimer K. Race, family structure, and delinquency: A test of differential association and social control theories. American Sociological Review. 1987; 52:826–840.

Menard S, Elliott DS. Delinquent bonding, moral beliefs, and illegal behavior: a three-wave panel model. Justice Quarterly. 1994; 11:173–188.

Menard S, Johnson MC. An intergenerational test of integrated theory. Deviant Behavior. 2015; 36:87–100.

Mihalic, S.; Fagan, A.; Irwin, K.; Ballard, D.; Elliott, DS. Blueprints for Violence Prevention replications: Factors for implementation success. Boulder, CO: University of Colorado, Center for the Study and Prevention of Violence; 2002.

Mood C. Logistic regression: Why we cannot do what we think we can do, and what we can do about it. European Sociological Review. 2010; 26:67–82.

Odger CL, Caspi A, Nagin DS, Piquero AR, Slutske WS, Milne BJ, … Moffitt TE. Is it important to prevent early exposure to drugs and alcohol among adolescents? Psychological Science. 2008; 19:1037–1044. [PubMed: 19000215]

O'Keeffe GS, Clarke-Pearson K. The impact of social media on children, adolescents, and families. Pediatrics. 2011; 127:800–804. [PubMed: 21444588]

Paternoster R, Iovanni L. The deterrent effect of perceived severity: A re-examination. Social Forces. 1986; 64:751–777.

Piquero NL, Gover AR, MacDonald JM, Piquero AR. The influence of delinquent peers on delinquency: Does gender matter? Youth and Society. 2005; 36:251–275.

Polderman TJ, Benyamin B, De Leeuw CA, Sullivan PF, Van Bochoven A, Visscher PM, Posthuma D. Meta-analysis of the heritability of human traits based on fifty years of twin studies. Nature genetics. 2015; 47:702–709. [PubMed: 25985137]

Pratt TC, Cullen FT, Sellers CS, Winfree LT Jr, Madensen TD, Daigle LE, … Gau JM. The empirical status of social learning theory: A meta-analysis. Justice Quarterly. 2010; 27:765–802.

Sigfusdottir ID, Kristjansson AL, Agnew R. A comparative analysis of general strain theory. Journal of Criminal Justice. 2012; 40:117–127.

Skinner, BF. Science and human behavior. New York, NY: Simon & Schuster; 1951.

Smith, CA.; Lizotte, AJ.; Thornberry, TP.; Krohn, MD. Resilient youth: Identifying factors that prevent high-risk youth from engaging in delinquency and drug use. In: Hagan, J., editor. Delinquency and Disrepute in the Life Course. Greenwich., CT: JAI Press; 1995. p. 217-247.

Sutherland, EH. Principles of criminology. Philadelphia, PA: J. B. Lippincott Company; 1939.

Thornberry TP. Toward an interactional theory of delinquency. Criminology. 1987; 25:863–91.

Thornberry, TP. Final report for grant#5R01MH063386. National Institute of Mental Health; Bethesda, MD: 2013. Life course continuity and change in antisocial behavior.

Thornberry TP, Freeman-Gallant A, Lizotte AJ, Krohn MD, Smith CA. Linked lives: The intergenerational transmission of antisocial behavior. Journal of Abnormal Child Psychology. 2003; 31:171–184. [PubMed: 12735399]

Thornberry TP, Freeman-Gallant A, Lovegrove PJ. Intergenerational linkages in antisocial behavior. Criminal Behaviour and Mental Health. 2009; 19:80–93. [PubMed: 19274625]

Thornberry, TP.; Krohn, MD. Applying interactional theory to the explanation of continuity and change in antisocial behavior. In: Farrington, DP., editor. Integrated developmental and life-course theories of offending. New Brunswick, NJ: Transaction Publishers; 2005. p. 183-209.

Thornberry TP, Lizotte AJ, Krohn MD, Farnworth M, Jang SJ. Testing interactional theory: An examination of reciprocal causal relationships among family, school, and delinquency. Journal of Criminal Law and Criminology. 1991; 82:3–35.

Vakalahi HF. Adolescent substance use and family-based risk and protective factors: A literature review. Journal of Drug Education. 2001; 31:29–46. [PubMed: 11338964]

Vazsonyi AT, Belliston LM. The family → low self-control → deviance: A cross-cultural and cross-national test of self-control theory. Criminal Justice and Behavior. 2007; 34:505–530.

Wiatrowski MD, Griswold DB, Roberts MK. Social control theory and delinquency. American Sociological Review. 1981; 46:525–541.

Appendix. Comparability of Measures Used in Each Generation

G2 Analysis		G3 Analysis	
		Drug use	
Since your last interview, did you …		*Since your last interview, did you …*	
1	Use marijuana, reefer or pot?	**1**	Use marijuana, weed, or reefer?
2	Inhale things, other than cigarettes, like glue to get high?	**2**	Inhale things, other than cigarettes, to get high?
3	Use LSD, acid, or cubes?	**3**	Use acid, LSD, psychedelics, or hallucinogens?
4	Use angel dust or PCP?	**4**	Use angel dust or PCP?
5	Use tranquilizers, ludes or valium?	**5**	Use tranquilizers?
6	Use downers, yellow jackets or red or blue devils?	**6**	Use downers or barbiturates?
7	Use uppers, speed, bennies or black beauties?	**7**	Use uppers or amphetamines?
		8	Use cocaine, coke, crack, or heroin?

G2 Analysis		G3 Analysis	
8	Use cocaine, coke or snow, other than crack?	**9**	Use Ecstasy, “E”, “X”, or other club drugs?
9	Use crack?		
10	Use heroin or smack?		
	Attachment to child		
How often would you say that … (Often, Sometimes, Seldom, Never)		*How often would you say that … (Always, Often, Sometimes, Seldom, Never)*	
1	You get along well with your child?	**1**	You get along well with your child?
2	You just do not understand your child?	**2**	You just do not understand your child?
3	Your child is too demanding?	**3**	Your child is too demanding?
4	You really enjoy your child?	**4**	You really enjoy your child?
5	Your child interferes with your activities?	**5**	Your child interferes with your activities?
6	You think your child is terrific?	**6**	You think your child is terrific?
7	You feel very angry toward your child?	**7**	You feel very angry toward your child?
8	You feel violent toward your child?	**8**	You feel violent toward your child?
9	You feel proud of your child?	**9**	You feel proud of your child?
10	You wish your child was more like others that you know?	**10**	You wish your child was more like other children that you know?
11	You feel that you can really trust your child?	**11**	Your child is well behaved?
	Commitment to school		
(Strongly Agree, Agree, Disagree, Strongly Disagree)		*(Strongly Agree, Agree, Disagree, Strongly Disagree)*	
1	You like school a lot.	**1**	You like school a lot.
2	School is boring to you.	**2**	School is boring to you.
3	You do poorly at school.	**3**	You do poorly at school.
4	You don’t really belong at school.	**4**	You don’t really belong at school.
5	Homework is a waste of time.	**5**	Homework is a waste of time.
6	You try hard at school.	**6**	You try hard at school.
7	You usually finish your homework.	**7**	You usually finish your homework.
8	Getting good grades is very important to you.	**8**	Getting good grades is very important to you.
9	Sometimes you do extra work to improve your grades.	**9**	Sometimes you do extra work to improve your grades.
(Definitely go out with friends, Probably go out with friends, Probably study, Definitely study)		*(Definitely go out with friends, Probably go out with friends, Probably study, Definitely study)*	
10	If you could choose on your own between studying to get a good grade on a test or going out with your friends, would you …	**10**	If you could choose on your own between studying to get a good grade on a test or going out with your friends, would you …
	Conventional activities		
Since your last interview, how often did you take part in …		*Since your last interview, how often did you take part in … (Often, Sometimes, Almost never, Never)*	

G2 Analysis		G3 Analysis	
(Often, Sometimes, Seldom, Never)		**1**	Organized sports or teams outside of school?
1	Organized sports or teams outside of school?	**2**	School sports?
2	School sports?	**3**	School activities like clubs or special events like a school play?
3	Activities like clubs or special events?	**4**	Other organized groups like the “Y” or like Boys or Girls Clubs?
4	Other organized groups like the “Y” or like Boys or Girls Clubs?	**5**	Any organized musical or singing groups, including in school?
5	Any organized musical or singing groups, including in school?	**6**	Church or religious activities?
6	Church or religious activities?		Note: Items 1–2 and 3–4 are each combined into 1 activity, yielding a range of 0–4 activities.
	Note: Items 1–2 and 3–4 are each combined into 1 activity, yielding a range of 0–4 activities.		
	Parent marijuana use		
1	Do you currently use marijuana?	**1**	Since your last interview, have you used marijuana, reefer, or weed?
	Peer drug use		
Since your last interview, how many of your friends … (Most of them, Some of them, A few of them, None of them)		*Since your last interview, how many of your friends … (Most of them, Some of them, A few of them, None of them)*	
1	Used marijuana, reefer, or pot?	**1**	Used marijuana, weed, or reefer?
2	Drank alcohol?	**2**	Drank beer, wine, or liquor?
3	Used hard drugs such as heroin, cocaine, LSD, or acid?	**3**	Used hard drugs such as crack, heroin, cocaine, LSD, or acid?
4	Used crack?	**4**	Used ecstasy, “E”, “X”, or other club drugs?
	Risky time with friends		
How often do you and your friend … (Every day, 3–4 times/week, 2 times/week, 1 time/week or less, Never)		*How often do you and any of these friends … (Every day, 3–6 times/week, 2 times/week, 1 time/week or less, Never)*	
1	Get together where no adults are present?	**1**	Get together where no adults are present?
2	Drive around with no special place to go?	**2**	Drive around with no special place to go?
3	Get together where someone is using or selling drugs or alcohol?	**3**	Get together where someone is using or selling drugs, beer, wine, or liquor?
	Note: This set is asked 3 times, once for each of the respondent’s 3 best friends.	**4**	Hang out at a mall?
		5	Hang out on a street corner or on the streets?
			Note: This set is asked once, for any of the respondent’s 3 best friends.
	Delinquent beliefs		
How wrong do you think it is to … (Very wrong, Wrong, A little bit wrong, Not wrong at all)		*How wrong do you think it is to … (Very wrong, Wrong, A little bit wrong, Not wrong at all)*	

G2 Analysis		G3 Analysis	
1	Use hard drugs such as crack, heroin, cocaine, LSD, or acid?	**1**	Use hard drugs such as crack, heroin, cocaine, LSD, or acid?
2	Use marijuana, reefer, or pot?	**2**	Use marijuana, weed, or reefer?
3	Drink alcohol?	**3**	Drink beer, wine, or liquor?
4	Use a weapon or force to get money or things from people?	**4**	Use a weapon or force to get money or things from people?
5	Attack someone with a weapon or with the idea of seriously hurting them?	**5**	Attack someone with a weapon or with the idea of seriously hurting them?
6	Hit someone with the idea of hurting them?	**6**	Hit someone with the idea of hurting them?
7	Take a car or motorcycle for a ride without the owner's permission?	**7**	Take a car or motorcycle for a ride without the owner's permission?
8	Steal something worth $50?	**8**	Steal something worth $50?
9	Damage or destroy someone else's property on purpose?	**9**	Damage or destroy someone else's property on purpose?
10	Skip classes without an excuse?	**10**	Skip classes without an excuse?
11	Steal something worth $100?		

Table 1

Descriptive Statistics for All Study Variables for G2 and G3

	G2[a] analyses					G3[b] analyses				
	n	**Mean**	**SD**	**Range**	**α**	**n**	**Mean**	**SD**	**Range**	**α**
Outcome variable										
Self-reported drug use	914	0.23	0.42	0–1	na	311	0.17	0.38	0–1	na
Predictor variables										
Social control theory										
Parent report										
Attachment to child	856	3.47	0.43	1.6–4	0.81	299	3.79	0.29	2.5–4	0.85
Child report										
Commitment to school	885	3.07	0.35	1.6–4	0.81	310	3.23	0.43	1.7–4	0.79
Conventional activities	885	2.37	1.21	0–4	na	309	2.54	1.26	0–4	na
Social learning theory										
Parent report										
Parent marijuana use	850	0.05	0.22	0–1	na	298	0.13	0.34	0–1	na
Child report										
Peer drug use	866	1.30	0.46	1–4	na	309	1.15	0.36	1–3.5	na
Risky time with friends	885	1.99	0.62	1–4.2	0.77	309	1.54	0.55	1–4.2	0.62
Delinquent beliefs	891	1.25	0.34	1–3.8	0.84	309	1.29	0.40	1–3.7	0.87
Control Variables										
G2 male	914	0.73	0.45	0–1	na	311	0.56	0.50	0–1	na
Resident arrest rate	914	4.20	2.07	0.12–7.87	na	311	4.59	1.98	0.12–7.87	na
G3 male						311	0.50	0.50	0–1	na
G2 age at first birth						311	18.94	2.20	13.2–23.6	na

[a]Parent of G3 during adolescence.

[b]First born adolescent child of G2.

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Table 2

Bivariate Relationships between Theoretical Variables and Drug Use for G2 and G3

	G2[a]			G3[b]		
	OR	**95% CI**	**n**	**OR**	**95% CI**	**n**
Social control theory						
Parent report						
Attachment to child	0.41	[0.29, 0.59]	856	0.39	[0.15, 0.99]	299
Child report						
Commitment to school	0.33	[0.20, 0.52]	885	0.18	[0.09, 0.38]	310
Conventional activities	0.80	[0.71, 0.91]	885	0.82	[0.65, 1.03]	309
Social learning theory						
Parent report						
Parent marijuana use	2.06	[1.10, 3.85]	850	3.00	[1.42, 6.36]	298
Child report						
Peer drug use	5.72	[4.01, 8.16]	866	6.79	[3.10, 14.88]	309
Risky time with friends	2.27	[1.76, 2.92]	885	3.22	[1.93, 5.36]	309
Delinquent beliefs	5.22	[3.32, 8.22]	891	5.26	[2.61, 10.60]	309
Control Variables						
G2 male	1.03	[0.73, 1.46]	914	1.27	[0.70, 2.32]	311
Resident arrest rate	1.05	[0.97, 1.13]	914	0.90	[0.79, 1.05]	311
G3 male				0.75	[0.41, 1.35]	311
G2 age at first birth				0.94	[0.82, 1.07]	311

[a] Parent of G3 during adolescence.

[b] First born adolescent child of G2.

Table 3

Logistic Regression Models for G2 and G3 Drug Use

	G2[ac]		G3[bd]		Equality of coefficients	
	OR	**95% CI**	**OR**	**95% CI**	**χ^2**	**p**
Social learning theory	(n = 817)		(n = 297)			
Parent marijuana use	1.94	[0.96, 3.94]	2.87	[1.18, 6.95]	0.46	0.50
Peer drug use	3.88	[2.54, 5.94]	2.83	[1.05, 7.65]	0.33	0.57
Risky time with friends	1.67	[1.26, 2.22]	2.38	[1.25, 4.51]	0.96	0.33
Delinquent beliefs	1.80	[1.03, 3.12]	2.41	[0.89, 6.51]	0.26	0.61
G2 male	1.03	[0.69, 1.55]	1.31	[0.62, 2.77]	0.30	0.58
Resident arrest rate	1.03	[0.95, 1.13]	0.87	[0.72, 1.04]	2.88	0.09
G3 male			0.79	[0.39, 1.60]		
G2 age at first birth			0.91	[0.76, 1.08]		
Social control theory	(n = 820)		(n = 298)			
Attachment to child	0.49	[0.33, 0.72]	0.75	[0.26, 2.21]	0.56	0.46
Commitment to school	0.38	[0.23, 0.63]	0.23	[0.10, 0.53]	1.03	0.31
Conventional activities	0.85	[0.74, 0.98]	0.89	[0.69, 1.15]	0.11	0.74
G2 male	0.99	[0.68, 1.46]	1.43	[0.70, 2.89]	0.78	0.38
Resident arrest rate	1.06	[0.98, 1.15]	0.91	[0.77, 1.07]	2.64	0.10
G3 male			0.72	[0.37, 1.37]		
G2 age at first birth			0.92	[0.78, 1.08]		
Elaborated theories	(n = 791)		(n = 297)			
Attachment to child	0.68	[0.44, 1.05]	0.77	[0.23, 2.63]	0.03	0.86
Commitment to school	0.63	[0.35, 1.11]	0.29	[0.11, 0.75]	1.82	0.18
Conventional activities	0.84	[0.72, 0.98]	0.88	[0.66, 1.17]	0.07	0.79
Parent marijuana use	1.77	[0.84, 3.75]	2.76	[1.10, 6.95]	0.54	0.46
Peer drug use	3.68	[2.34, 5.79]	3.62	[1.30, 10.13]	< 0.01	0.97
Risky time with friends	1.78	[1.32, 2.40]	2.31	[1.19, 4.47]	0.50	0.48
Delinquent beliefs	1.38	[0.75, 2.55]	1.61	[0.56, 4.64]	0.06	0.80
G2 male	1.00	[0.66, 1.52]	1.36	[0.63, 2.95]	0.46	0.50
Resident arrest rate	1.04	[0.95, 1.14]	0.88	[0.73, 1.07]	2.42	0.12

	G2[ac]		G3[bd]		Equality of coefficients	
	OR	95% CI	OR	95% CI	χ^2	p
G3 male			0.75	[0.36, 1.56]		
G2 age at first birth			0.90	[0.75, 1.07]		

[a] Parent of G3 during adolescence.

[b] First born adolescent child of G2.

[c] Each model also controls for G2 gender and resident arrest rate.

[d] Each model also controls for G2 gender, resident arrest rate, G3 gender, and G2 age at first birth.